

Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

MEMORANDUM

To: EPA and Ecology
From: LDWG
Subject: Rockfish in the Lower Duwamish Waterway (FINAL)
Date: July 14, 2004

This draft memorandum presents available information regarding potential use of the Lower Duwamish Waterway (LDW) by rockfish, including existing fish survey data from the LDW and pertinent rockfish life history data. As discussed in Sections 3.1.6 and 3.3.1.2 of the Phase 2 work plan (Windward 2004b), these data are needed to determine whether a rockfish site-use survey is justified to support the Phase 2 ecological and human health risk assessments. The remainder of this memo is presented in the following four sections:

- ◆ problem definition
- ◆ site use information
- ◆ recommendation regarding a site-use survey
- ◆ references

PROBLEM DEFINITION

Fish receptors of concern (ROCs) in the Phase 1 ecological risk assessment (ERA) were juvenile chinook salmon, English sole, and bull trout. Bull trout served as a representative of higher-trophic-level fish because bull trout consume other fish (i.e., bull trout are piscivorous). Rockfish were not included as either a ROC in the Phase 1 ERA or as a key prey item in the Phase 1 ERA or human health risk assessment (HHRA) because: 1) no data were available regarding concentrations of chemicals in rockfish tissue collected from the LDW, 2) rockfish have been infrequently collected from the LDW (see site use section below), and 3) although 13 Puget Sound rockfish species have been listed by the Washington Department of Fish and Wildlife (WDFW) as candidates for protected status within Washington state, none are currently listed under the Federal Endangered Species Act (ESA). Chemical data from analysis of LDW-collected tissue samples of juvenile chinook salmon, English sole, and perch were used in the Phase 1 ERA and/or HHRA to provide preliminary estimates of risks from sediment-associated chemicals.

For Phase 2, two meetings have been held with local experts who are knowledgeable about fish distribution and habitat, and who have experience with fish collection in the LDW. These meetings were held to help identify key species to be collected for chemical analyses to assess risks. The first meeting, held on January 21, 2003, focused on the identification of a higher-trophic-level fish for collection from the LDW to replace bull trout in the Phase 2 ERA. Bull trout was replaced as an ROC in Phase 2 because they only occasionally use the LDW,¹ and cannot be collected without a take permit because they are listed as a threatened species under the ESA. At the January 21, 2003 meeting, the Pacific staghorn sculpin was selected as a suitable higher-trophic-level fish for collection and analysis in the Phase 2 ERA. Rockfish were also suggested as a candidate higher-trophic-level fish for collection because of their piscivorous diet and long lifespan. However, it was agreed that rockfish use the site much less than sculpin; thus, rockfish were not selected for that purpose. Nevertheless, questions were raised regarding site use by rockfish and whether rockfish should be collected for chemical analyses. Based on these discussions, a rockfish site use survey was included in the data needs memo for Phase 2.

Adult rockfish, if present in the LDW, could serve three roles in Phase 2: 1) as another ROC representing higher-trophic-level fish in the ERA, 2) as higher-trophic-level prey species for piscivorous wildlife in the ERA, and 3) as a component of the seafood exposure scenario in the HHRA. Higher-trophic-level fish may have higher concentrations of bioaccumulative chemicals in their tissues, and thus may either be at higher risk themselves from exposure to sediment-associated chemicals, or result in higher risks to piscivorous wildlife or humans that may consume them (assuming they are sufficiently abundant to support high consumption rates). Juvenile rockfish do not present the same level of concern as adults for the Phase 2 risk assessments because they are not believed to feed at a higher trophic level than Pacific staghorn sculpin, based on available data for rockfish (Table 1). Thus, the Pacific staghorn sculpin would be a suitable surrogate for juvenile rockfish in the ERA.

Table 1. Life history information for selected rockfish^a and Pacific staghorn sculpin

SPECIES	LIFESTAGE	LENGTH (cm)	DIET	HABITAT
Copper rockfish	adult (4+ years)	> 30	pelagic fish, demersal and pelagic crustaceans (Murie 1995)	high-relief reefs or low-relief reefs with macrophytes (Matthews 1990b)
Copper rockfish	juvenile	< 30	demersal crustaceans and to a lesser extent pelagic crustaceans and pelagic fish (Murie 1995)	eelgrass, kelp, low-relief reefs (Matthews 1990a)

¹ Bull trout are believed to forage significantly in the LDW only during times of large abundances of small fish, such as just after the live birthing period for perch (Shannon 2001). Risks to bull trout in the Phase 2 ERA will be discussed qualitatively; however, bull trout will not be evaluated as a ROC.

SPECIES	LIFESTAGE	LENGTH (cm)	DIET	HABITAT
Quillback rockfish	adult (4+ years)	> 25	pelagic fish, demersal and pelagic crustaceans (Murie 1995)	high-relief reefs or low-relief reefs with macrophytes (Matthews 1990a)
Quillback rockfish	juvenile	< 25	pelagic and demersal crustaceans and to a lesser extent pelagic fish (Murie 1995)	sand/eelgrass, kelp, complex areas on low-relief reefs (Matthews 1990a; West et al. 1994)
Brown rockfish	adult (4+ years)	> 22	small fishes, crabs, shrimps, isopods, and polychaetes (Love 1996; Stein and Hassler 1989)	natural reefs and rock piles in water less than 30 m (Matthews 1990a)
Brown rockfish	juvenile	< 22	amphipods, copepods, and polychaetes (Matthews 1987)	shallow, vegetated habitats such as beds of kelp or eelgrass (West et al. 1994)
Pacific staghorn sculpin	juvenile	<15	amphipods and nereid worms (Jones 1962)	shallow inshore estuarine habitats
Pacific staghorn sculpin	adult	> 15	shrimp, brachyuran crabs, fish, amphipods, polychaetes (Fresh et al. 1979; Miller et al. 1977b; Wingert et al. 1979)	commonly found near shore, especially in bays and estuaries; most frequently on sandy bottom (Eschmeyer et al. 1983)

nd – no data

^a Information is presented for copper, quillback, and brown rockfish because of all rockfish species, these rockfish are most likely to occur in the LDW based on their distribution in Puget Sound and their presence in Elliott Bay.

At a more recent meeting of local fish experts on March 31, 2004, site use by rockfish was further discussed, as were potential survey options. At that meeting, questions were raised regarding the extent of site use by adult rockfish because no adults have been observed in the LDW. Questions were also raised whether a comprehensive survey, which would potentially be dangerous to divers,² was justified based on the available data. These questions were acknowledged in the Phase 2 work plan (Windward 2004b), in which this technical memorandum was proposed to summarize the available data and recommend whether a site use survey was justified.

SITE USE INFORMATION

To assess potential site use by rockfish in the LDW, existing survey data were reviewed and local fish experts were contacted. Based on the distribution of rockfish throughout Puget Sound and their presence in Elliott Bay, three rockfish species may occur in the LDW: quillback rockfish (*Sebastes maliger*), copper rockfish (*S. caurinus*), and brown rockfish (*S. auriculatus*) (Christiansen 2004).

Since 1968, ten fish surveys have been conducted in the LDW covering many years of sampling in all seasons (Table 2). Of these surveys, only one study reported capturing

² The LDW is a working industrial waterway with low water visibility and underwater debris. If conducted, the survey would target areas of overhanging concrete and other underwater areas with structure (e.g., riprap). Because rockfish are most active at dusk, surveys should be conducted near dusk to best assess numbers present in the LDW, which is an additional risk factor for SCUBA divers.

rockfish in a trawl or beach seine in the vicinity of the LDW. Malins et al. (1980) reported that one to five rockfish per season were collected on the south side of Harbor Island³ using an otter trawl. Malins et al. (1980) did not report the age or size of fish captured, or the number of trawls conducted. No rockfish were reported by Malins et al. (1980) at three upstream sampling locations (above Kellogg Island, near the 1st Ave S bridge, and near the 14th Ave S bridge). With the exception of Malins et al. (1980), rockfish have not been reported in other surveys conducted using beach seines, gill nets, or trawls, or in recreational angler interviews (Table 1). However, because rockfish tend to have a strong affinity for particular marine locations with structure (Richards 1987), neither trawling nor beach seining, the most frequently employed techniques in the LDW, is likely to be an appropriate technique to capture rockfish or to determine the extent of site use. Thus, the absence of adult rockfish in these surveys does not necessarily indicate that adult rockfish are absent from the LDW.

³ The south side of Harbor Island is the downstream (northern) boundary of the LDW.

Table 2. Summary of studies assessing fish communities in the LDW^{a, b}

SURVEY CITATION	YEAR SURVEYED	SAMPLING FREQUENCY	GEAR	NUMBER OF LOCATIONS SAMPLED	LOCATIONS	ROCKFISH OBSERVED
Shannon (2004)	Apr-Aug 1998, 2001, and 2002	biweekly	beach seine	7 (2 in LDW)	Kellogg Island and Turning Basin 3 area	no
Robertson (2004)	Oct 1998	single visit to each site	SCUBA	8 (6 in LDW)	Harbor Island to south side of 1 st Ave S. Bridge	yes (8 juveniles)
West (2001)	1992-1997	6 trawls over survey duration	otter trawl	1	Kellogg Island	no
Warner and Fritz (1995)	Feb-Sep 1994	biweekly, but weekly April and May	beach seine	9 (7 in LDW)	Kellogg Island to above rapids (RM 8.5)	no
Meyer et al. (1981)	Apr-Jul 1980	biweekly, but weekly mid April-June	purse seine	2	Kellogg Island and at S Kenyon St (RM 3)	no
Meyer et al. (1981)	Apr-Jul 1980	biweekly, but weekly mid April-June	beach seine	2	Kellogg Island and at S Kenyon St (RM 3)	no
Weitkamp and Campbell (1980)	Oct 1977- Aug 1978	quarterly	gill net (surface and bottom)	1	South end of Kellogg Island	no
Weitkamp and Campbell (1980)	Oct 1977 – Aug 1978	monthly October-February plus July and August; more frequently March-June	purse seine	5	Kellogg Island and adjacent channel	no
Weitkamp and Campbell (1980)	Oct 1977 – Aug 1978	monthly October-February plus July and August; more frequently March-June	beach seine	5	Kellogg Island and adjacent channel	no
Malins et al. (1980)	1979	quarterly	7.5-m otter trawl	1 in LDW	South end of Harbor Island	yes (42 ^c)
Miller et al. (1975; 1977a)	1974-1975	monthly	5-m otter trawl	8 (7 in LDW)	West Waterway to Turning Basin 3	no
Matsuda (1968)	1964-1966	weekly	beach seine	2	upper and lower LDW (exact locations unknown)	no
King County creel survey (Simmonds et al. 1998)	1997	10 weekends and 10 weekdays from June through August	angler interviews regarding recreational catch	24 (8 in LDW)	Harbor Island to Duwamish Waterway Park	no

^a US Army Corps of Engineers conducted beach seine and fyke net sampling in the LDW in 2002 and 2003; the draft report is not yet available. Rockfish were not collected in either year (Goetz 2004). PSEP conducted otter trawls in the LDW in 1985, but data are only available in summary form combined with Elliott Bay data; raw data are not available.

^b Glen St. Amant (Muckleshoot Tribe) has noted that there is some anecdotal information that tribal fishers have caught rockfish in their Lower Duwamish Waterway gill nets; however, no specific information is available regarding whether the fish were caught in the LDW or further downstream in the East Waterway or West Waterway where adults have been documented in surveys, or the frequency of catch or size or species of rockfish caught.

^c Size and age of fish caught were not reported

In the LDW, SCUBA is the best method for surveying fish, such as rockfish, that prefer habitats with structure. The three rockfish species that may occur in the LDW prefer habitats with some degree of structural complexity. Brown rockfish are more of a habitat generalist than the other two species; brown rockfish are reported to aggregate near rocks, oil platforms, underwater pipes, and old tires (Love 1996; Matthews 1990a), and tend to occur more frequently in shallower water and brackish water (Stein and Hassler 1989). Quillback and copper rockfish are more commonly associated with artificial and natural high- and low-relief reefs (Matthews 1990a).

A single SCUBA survey of habitats with structure in the LDW has been conducted (Robertson 2004). As part of this survey, six locations throughout the LDW and one location in each of the East and West Waterways were examined from October 30 to December 12, 1998 by divers (Figure 1). The primary purpose of this survey was to capture striped and pile perch. Pile perch prefer habitats with structure; thus, most of the sites surveyed were those with structure. In this effort, juvenile quillback rockfish were observed by divers at two LDW locations with overhanging concrete or riprap. Fourteen quillback rockfish up to 10 cm in length were observed on the west side of the LDW at river mile (RM) 1.6,⁴ and a single juvenile quillback rockfish was observed near the pilings of the 1st Ave S bridge (Figure 1). No adult rockfish were observed in the LDW (Figure 1). In contrast, several adult brown and quillback rockfish were observed at the East Waterway location. Note, however, that rockfish were not the focus of this survey and every area with potential rockfish habitat (i.e., riprap and overhanging concrete) has not been surveyed.

The presence of subadult rockfish, but not adult rockfish, in the LDW may be attributable to shifting habitat requirements of rockfish as they age and grow. The three species of rockfish that may occur in the LDW are pelagic as juveniles. As juveniles grow, they develop a demersal lifestyle in bays and estuaries and are generally associated with structure. As rockfish age further, they tend to move to deeper water habitats with some degree of structure (Love 2002). Research has shown that brown, copper, and quillback rockfish tend to occupy habitats differently as they age and grow, with larger older fish most associated with high relief rocky reefs (Matthews 1990a).

RECOMMENDATION

Numerous field efforts are scheduled for 2004 and 2005 to reduce uncertainties identified in Phase 1 that could impact the conclusions of the Phase 2 risk assessments. One issue is whether rockfish should be further investigated in the LDW because chemical concentrations in rockfish tissue could influence either the Phase 2 ERA or HHRA conclusions.

⁴ River miles within the LDW are measured relative to the south end of Harbor Island.

Table 3 summarizes the way rockfish tissue data, if collected, would be used in the Phase 2 risk assessments, and the criteria that would need to be satisfied to potentially affect risk assessment conclusions.

Table 3. Phase 2 data needs relative to existing data

PHASE 2 DATA NEED	REQUIRED CRITERIA TO POTENTIALLY AFFECT RISK CONCLUSION	EXISTING DATA	CONCLUSION
Support the assessment of risks to fish	Site use by a population of adult ^a rockfish	No adult rockfish observed in LDW	Low potential to affect risk conclusion
Support the assessment of risks to wildlife	Would require use by many adult rockfish, which could potentially be consumed by wildlife	No adult rockfish observed in LDW	Low potential to affect risk conclusion
Support the assessment of risks to humans	Would require site use by many adult rockfish which could potentially be caught through recreational fishing	No adult rockfish observed in LDW; brown rockfish not generally caught by trawl or hook and line	Low potential to affect risk conclusion

^a Only adult rockfish (>4 years old) are expected to have a higher trophic status than other fish species currently targeted for collection and chemical analyses

With respect to rockfish themselves, to potentially affect risk conclusions for fish in the LDW, the data would need to show that adult rockfish occur in the LDW and are sufficiently abundant to constitute a component of the regional rockfish population (Puget Sound, including Elliott Bay and the East and West Waterways). This criterion does not appear to be met in the LDW. Instead, although a comprehensive survey of the LDW has not been conducted for rockfish, available data and expert opinion as expressed at the March 31, 2004 meeting suggest that adult rockfish are unlikely to be abundant south of Harbor Island, which is the northern boundary of the LDW site. As discussed at the March 31, 2004 meeting, juvenile rockfish present in the LDW are at a trophic level similar to or lower than Pacific staghorn sculpin. In a study from British Columbia, Murie (1995) found that 80% of subadult copper rockfish less than 15 cm in length consumed demersal crustaceans and about 10% of copper rockfish in this size class consumed pelagic fish. Similarly about 60% of subadult quillback rockfish less than 20 cm in length consumed demersal crustaceans and less than 10% consumed fish. Fresh (1979) in a study from the Nisqually estuary found that Pacific staghorn sculpin⁵ had fish in their stomachs 16% of the time, with demersal crustaceans constituting the majority of their diet. Because diets of subadult rockfish are similar to that of Pacific staghorn sculpin, exposure to sediment-associated chemicals will be represented by Pacific staghorn sculpin tissue data collected as part of the Phase 2 RI.

With respect to risks to piscivorous wildlife, consumption of rockfish is unlikely to affect risk conclusions because adult rockfish abundance is likely to be low in the LDW, based on available data, and thus would not represent a significant component of the piscivorous wildlife diet. Therefore, the potential for adult rockfish to impact risk

⁵ Sculpin size and age were not specified.

conclusions for piscivorous wildlife is low. Inclusion of juvenile rockfish would also be unlikely to affect risk conclusions for piscivorous wildlife because Pacific staghorn sculpin tissue data should serve as a suitable surrogate for juvenile rockfish in the ERA.

With respect to human health risks, adult rockfish are likely to constitute a very small component of a seafood consumption scenario because existing data suggest that adult rockfish abundance is low in the LDW, as discussed above. Additionally, brown rockfish, the species most likely to occur in the LDW, are notoriously difficult to catch with hook and line, as discussed at the March 31, 2004 meeting. However, there is some anecdotal information that tribal fishers have caught rockfish in gill nets deployed within the LDW; no specific information is available regarding whether fish were caught in the East Waterway, West Waterway, or the LDW, or the frequency of catch or size or species of rockfish caught. This potential source of uncertainty will be discussed in the LDW HHRA.

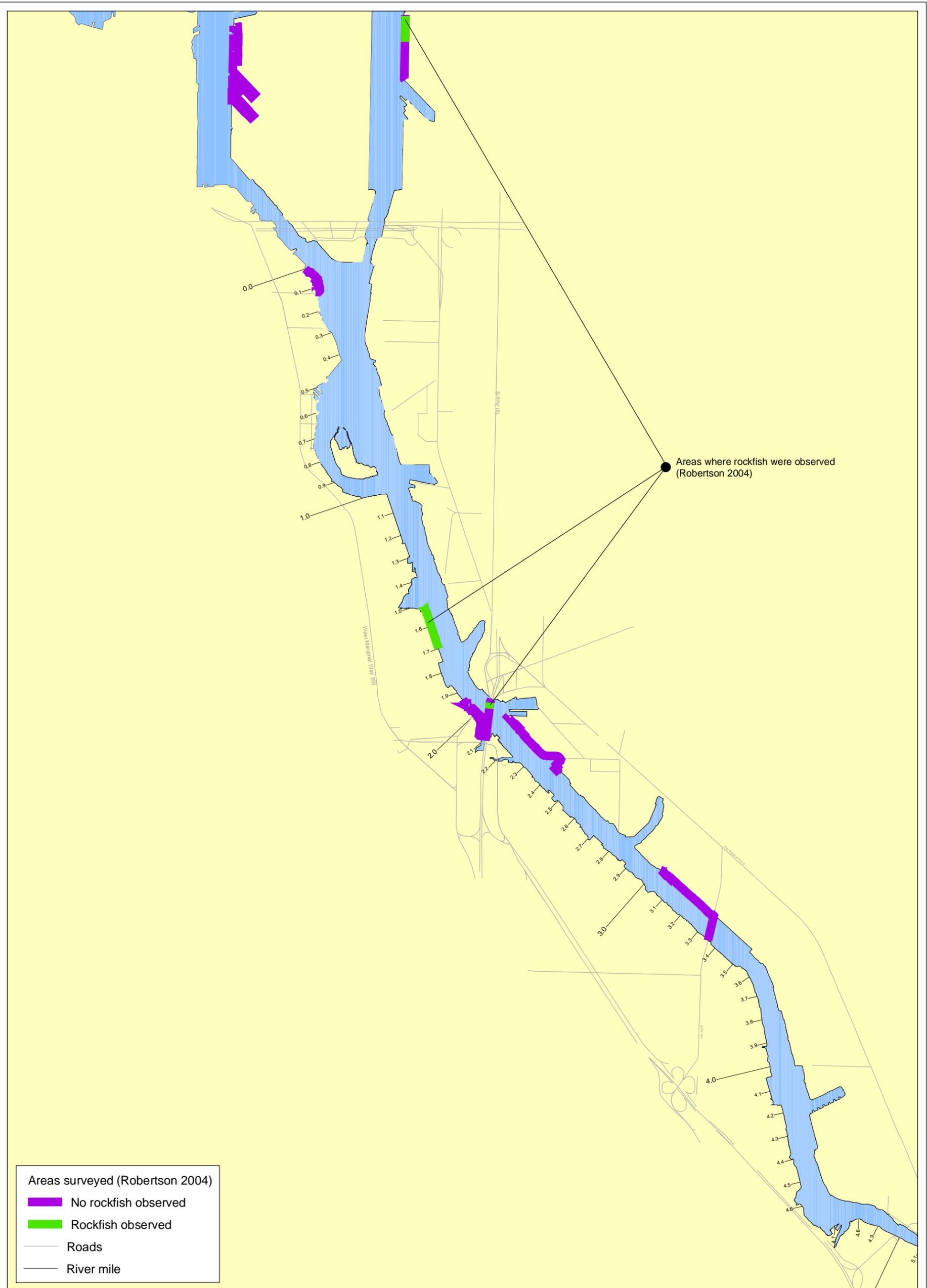
Therefore, it is the Lower Duwamish Waterway Group's recommendation, based on the information presented in this memo and the March 31, 2004 fish experts meeting, that the rockfish survey contemplated as part of Phase 2 work plan should not be conducted, and rockfish should not be targeted for Phase 2 tissue collection. However, if adult rockfish are collected incidentally as part of the Phase 2 fish tissue collection effort, these fish will be archived for potential chemical analyses, in accordance with the collection procedures outlined in the fish and crab tissue quality assurance project plan (QAPP) (Windward 2004a). The decision whether to analyze these tissues would depend on the number and location of fish caught, and would be made in consultation with EPA and Ecology.

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Areas surveyed (Robertson 2004)

- █ No rockfish observed
- █ Rockfish observed
- Roads
- River mile

Figure 1. Locations previously surveyed by SCUBA for rockfish in the LDW

The Robertson survey was conducted in 1998 using one surveying technique (SCUBA). Rockfish observed in the East Waterway were adults, while those observed in the LDW were juveniles. The Robertson survey is referenced as 2004 personal communication.

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